Name: Key Period: _____ Date: _____

Honors Chemistry Unit Test 1 Study Guide

Content

- Particle diagrams/writing chemical formulas
- Chemical/physical properties and changes
- Pure substance/element/compound/heterogeneous mixture/homogeneous mixture (solution)
- Separation of mixtures
- Atomic structure (subatomic particles' charge/mass/location, etc.)
- Atomic calculations for neutral atoms and ions
- Average atomic mass and percent abundance
- Electron configuration and orbital diagrams (including three rules)
- Quantum number theory and determining quantum numbers

Test Format

Multiple choice
Short answer

- Average atomic mass calculations
- Electron configuration/orbital diagrams
- Quantum numbers
- Written responses

Labs

Chemical vs. physical changes
Separation of mixtures
Flame test

Vocabulary

Angular momentum quantum number (ℓ)
Atom
Atomic mass
Atomic mass unit (amu)
Atomic number
Aufbau principle
Average atomic mass
Bohr
Chemical change
Chemical property
Compound
Corrosiveness
Electron
Electron configuration
Element
Energy level
Excited state
Flame test
Flammability
Ground state
Heterogeneous mixture
Homogeneous mixture
Hund's rule
Ion
Isotope
Magnetic quantum number (m_ℓ)
Mass number
Matter
Neutral atom
Neutron
Nucleus
Orbital
Orbital diagram
Pauli exclusion principle
Physical change
Physical property
Principle quantum number (n)
Proton
Pure substance
Quantum number
Reactivity
Relative abundance
Solubility
Solution
Spin quantum number (m_s)
Subatomic particle
Subshell/sublevel
Two types of isotope notation ($^{12}_{6}C$ and Carbon-12)

Unit 1 Practice Problems

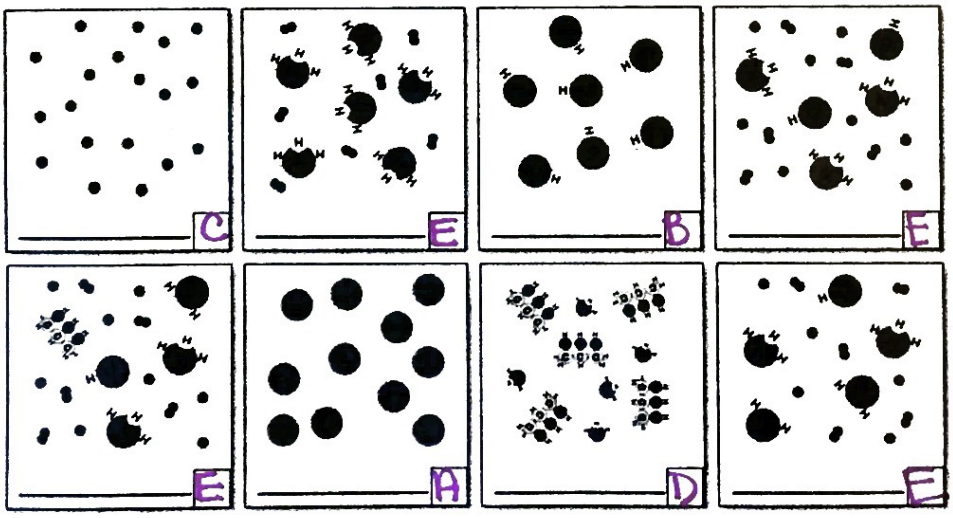
1. **Give two examples of each of the following:**

Type of Matter	Examples
Element	
Compound	
Heterogeneous mixture	
Homogeneous mixture	

answers will vary

2. **Classify each of the following diagrams by placing the correct label in the blanks below:**

A = element
B = compound
C = mixture of elements
D = mixture of compounds
E = mixture of elements and compounds



3. What is the BIGGEST difference between a chemical change and a physical change?

new substance produced

no new substance produced

4. **Below is a list of things that might happen during a chemical or physical change. Write a P next to the signs of a physical change and a C next to the signs of a chemical change.**

A. C New substance created
B. C Fizzing/foaming
C. P Phase change
D. P Shape/size change
E. C Flames/burning
F. P Something dissolving
G. C Gas produced

same

5. **Real life examples. Write a P next to the signs of a physical change and a C next to the signs of a chemical change.**

A. P Tearing a piece of paper
B. C Cooking eggs
C. P Dissolving salt in water
D. P Boiling water
E. P Crushing metal
F. P Melting ice
G. C Burning wood

6. **True-False** Classify each of the following statements as always true, **AT**; sometimes true, **ST**; or never true, **NT**.

ST 1. Atoms are composed of protons, electrons, and neutrons.
ST 2. Atoms of elements are neutral.
NT 3. The mass of an electron is equal to the mass of a neutron.
AT 4. The charge on all protons is the same.
ST 5. The atomic number of an element is the sum of the protons and electrons in the atom.
NT 6. The atomic number of an element is the whole number that decreases as you read across each row of the periodic table from left to right.
ST 7. An atom of nitrogen has 7 protons and 7 neutrons.
AT 8. The number of neutrons in the nucleus can be calculated by subtracting the atomic number from the mass number.

↳ H doesn't always have neutrons

(true if atom has no electrons, aka H)

7. Complete the following table. All atoms are NEUTRAL (#protons = #electrons).

Element	Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons
Fluorine	9	19	9	10	9
Ca	20	41	20	21	20
Al	13	27	13	14	13
Fe	26	56	26	30	26

8. Which of these statements is false?
   a. Electrons have a negative charge.
   b. Electrons have a mass of 1 amu.
   c. The nucleus of an atom is positively charged.
   d. The neutron is found in the nucleus of an atom.

9. An atom of an element with atomic number 48 and atomic mass 120 contains
   a. 48 protons, 48 electrons, and 72 neutrons.
   b. 72 protons, 48 electrons, and 48 neutrons.
   c. 120 protons, 48 electrons, and 72 neutrons.
   d. 72 protons, 72 electrons, and 48 neutrons.

   Which element is this? Cadmium

10. All atoms of the same element have the same:
   a. number of protons.
   b. number of neutrons.
   c. atomic mass.
   d. mass.

11. Which of these statements is *not* true?
   a. Atoms of the same element can have different atomic masses.
   b. The nucleus of an atom has a positive charge.
   c. Isotopes of an element have different numbers of protons.
   d. Atoms are mostly empty space.

Ions

Isotope Symbol	Atomic Number	Mass Number	# of protons	# of neutrons	# of electrons
$^{16}_{8}O^{-2}$	8	16	8	8	10
$^{7}_{4}Be^{+2}$	4	7	4	3	2
$^{24}_{11}Na^{+1}$	11	24	11	13	10

Element	Atomic Number	# Protons	# Electrons	Charge	Isotope Symbol
O atom that has gained 2 electrons	8	8	10	-2	$^{16}_{8}O^{-2}$
K atom that has lost 1 electron	19	19	18	+1	$^{39}_{19}K^{+1}$
Mg atom that has lost 2 electrons	12	12	10	+2	$^{24}_{12}Mg^{+2}$
F atom that has gained 1 electron	9	9	10	-1	$^{19}_{9}F^{-1}$
N atom that has gained 3 electrons	7	7	10	-3	$^{14}_{7}N^{-3}$
Sr atom that has lost 2 electrons	38	38	36	+2	$^{88}_{38}Sr^{+2}$

skip this column! I didn't give you enough info to complete

Electron Configuration

Identify the following elements based on their electron configurations.

1. $1s^2 2s^2$ beryllium
2. $1s^2 2s^2 2p^6 3s^2 3p^5$ chlorine
3. $1s^1$ hydrogen
4. $1s^2 2s^2 2p^6 3s^2 3p^1$ aluminum

In the space below, write the electron configurations of the following elements:

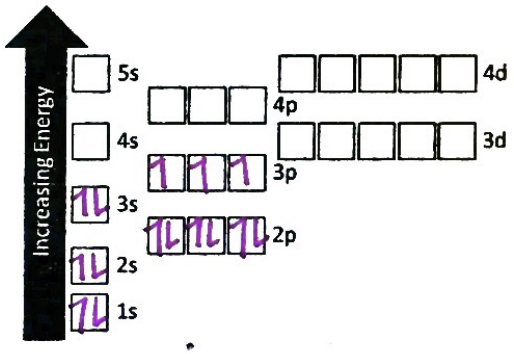
2) iron (full) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

3) bromine (full) $1s^2 2s^2 2p^6 3s^2 3p^6 4s$

4) barium (abbreviated) $[Xe] 6s^2$

Phosphorous has 15 electrons.

Unabbreviated electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^3$



Uranium is used in nuclear reactors and is a rare element on earth. Uranium has three common isotopes. If the abundance of ^{234}U is 0.01%, the abundance of ^{235}U is 0.71%, and the abundance of ^{238}U is 99.28%, what is the average atomic mass of uranium?

$(234 \times .0001) + (235 \times .0071) + (238 \times .9928)$

$= 237.98 \text{ amu}$

The average atomic mass of Thallium is 204.3833 amu. The masses for the two stable isotopes are 202.9723 amu for thallium-203 and 204.9744 amu for thallium-205. Calculate the percent abundance of each isotope.

$(202.9723 \cdot x) + 204.9744(1-x) = 204.3833$

$202.9723x + 204.9744 - 204.9744x = 204.3833$

$-2.0021x = -.5911$

$x = .2952 \longrightarrow$ Tl-203 = 29.52%

Tl-205 = 70.48%

Identify the element whose highest energy electron would have the following four quantum numbers:

11. 3, 1, -1, +1/2 $3p^1$ → Aluminum

12. 4, 2, +1, +1/2 $4d^4$ → Molybdenum

13. 6, 1, 0, -1/2 $6p^5$ → Astatine

14. 4, 3, +3, -1/2 $4f^{14}$ → Lutetium

15. 2, 1, +1, -1/2 $2p^6$ → Neon

Which of the following represents a permissible set of quantum numbers? (answer "yes" if permissible and "no" if no permissible)

16. 2, 2, +1, -1/2 yes

17. 5, 1, 0, +1/2 yes

18. 6, 3, -2, +1/2 no (no 6f)

19. 7, 0, 0, -1/2 yes

20. 4, 1, 8, +1/2 no

The quantum number n describes the energy level (distance from nucleus) of an atomic orbital.

The shape of an atomic orbital is given by the quantum number ℓ.

The maximum number of orbitals that may be associated with the set of quantum numbers n=4 and ℓ=3 is 7.

QNS

1) Nickel ($3d^8$)

$n=3, \ell=2$

$m_\ell = 0, m_s = -\frac{1}{2}$

2) Iodine